

# Survivor! (??)

## The story of *S. mitis* on the Moon



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"Solar System Exploration @ 50," October 25-26, 2012, Washington, D.C.

Introduction: A bug's tale...

Chapter 1: Microbes, sterilization, and lunar quarantine

Chapter 2: Surveyor III goes to the Moon, Apollo 12 follows

Chapter 3: Survivor(s) on the Moon?

Chapter 4: How a claim became a fact

Chapter 5: Contesting the claim

Chapter 6: For the record...*S. mitis* – survivor or interloper?

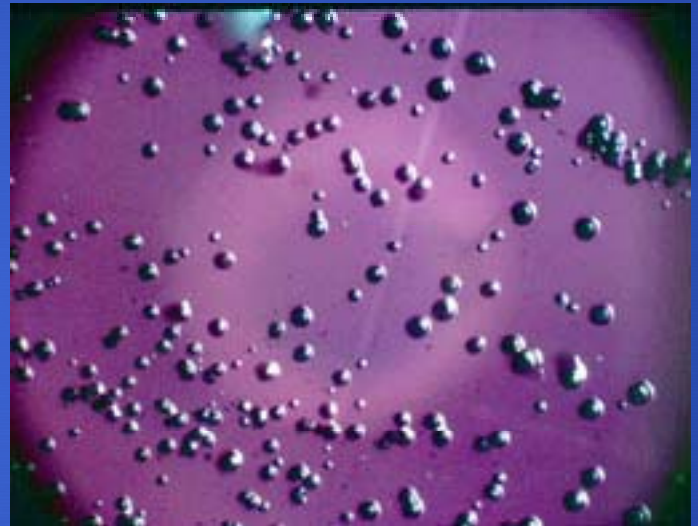
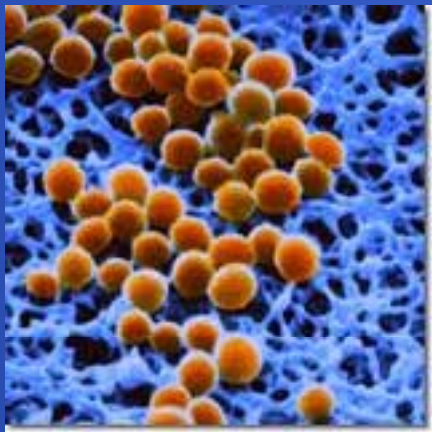
Conclusions: Why should we care about this story?

# Chapter 1:

Microbes, sterilization, and lunar quarantine



# Meet *Streptococcus mitis*...



## LRL's Surveyor III analysis



they are wearing masks and head co

## Chapter 2:

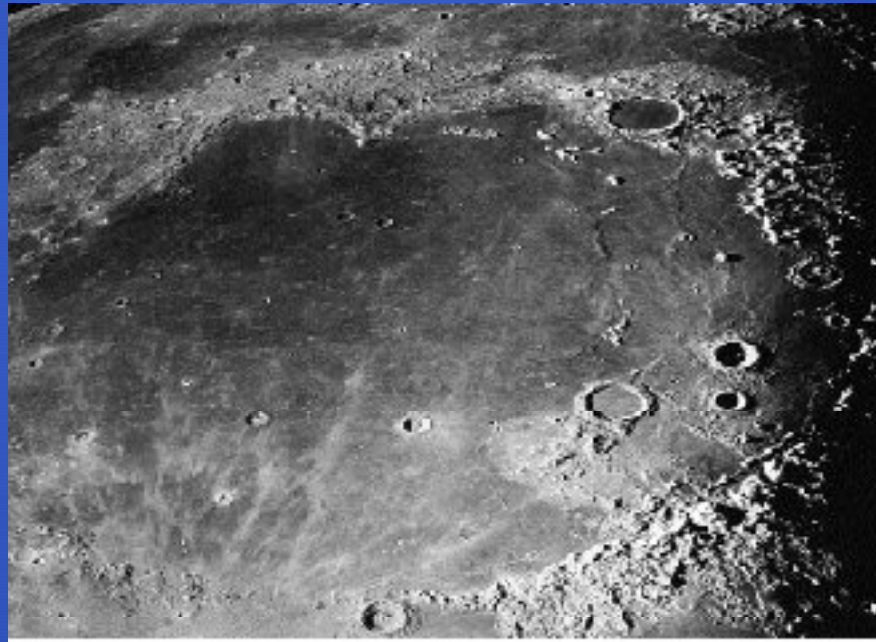
Surveyor III goes to the moon, Apollo 12 follows







# Surveyor III lands in the Ocean of Storms

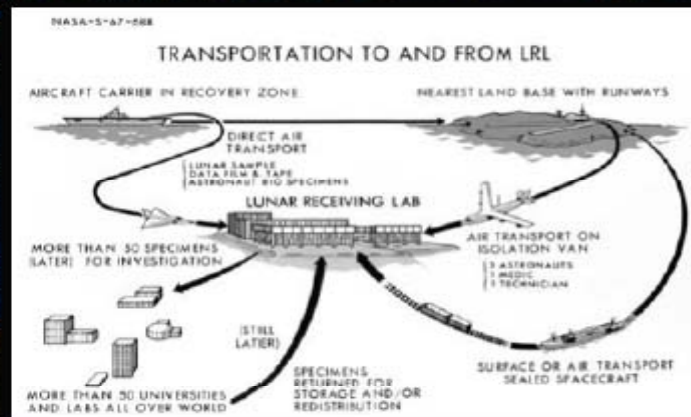




# Apollo XII Returned to the Earth



24 November 1969  
– 600 km East of Pago Pago



# Chapter 3:

## Survivor(s) on the Moon?



## LSC, 1971, Houston:

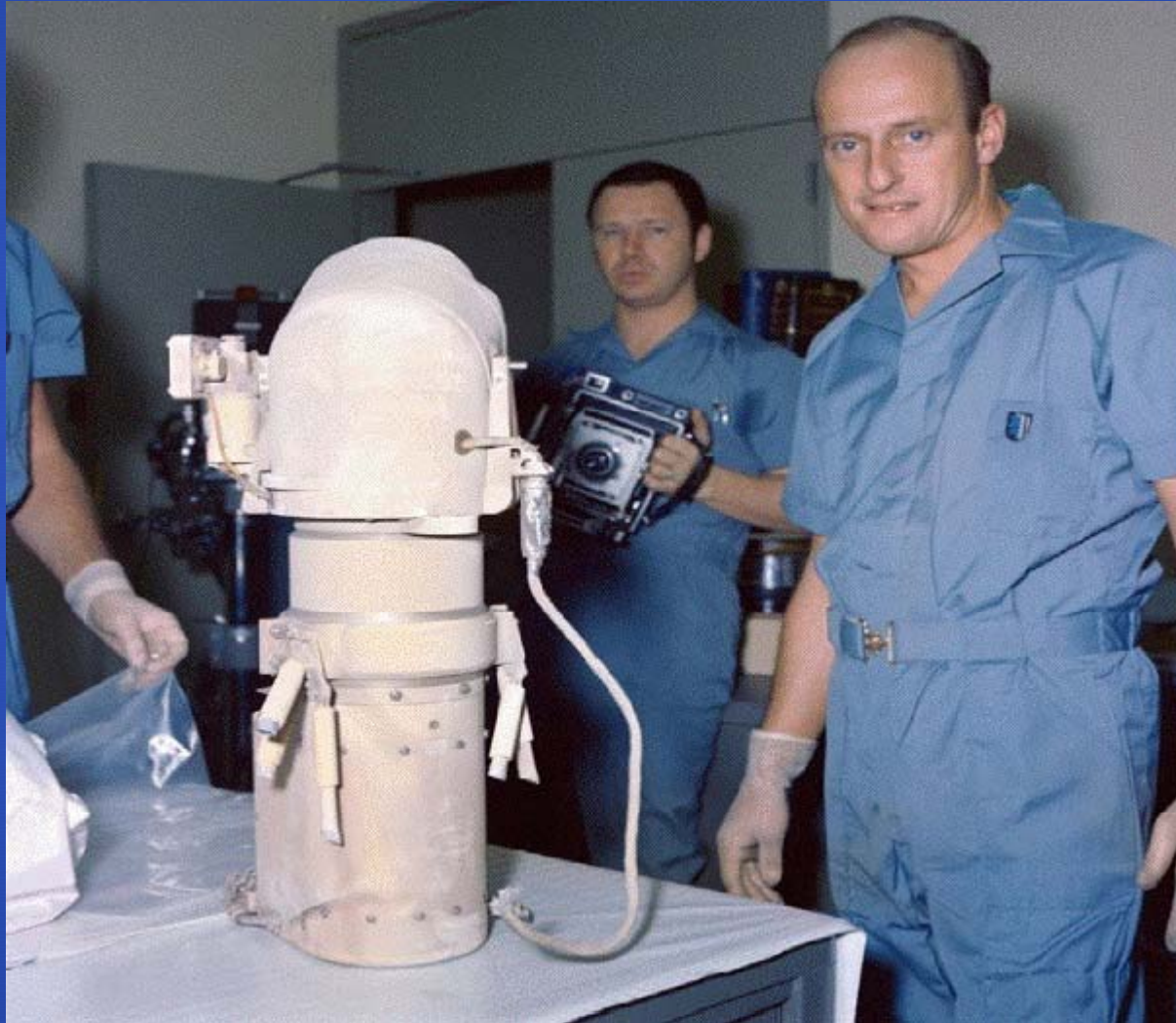
Mitchell and Ellis: "Surveyor III: bacterium isolated from lunar-retrieved TV camera"

Knittel, Favero, and Green: "Microbial sampling of returned Surveyor III electrical cabling"

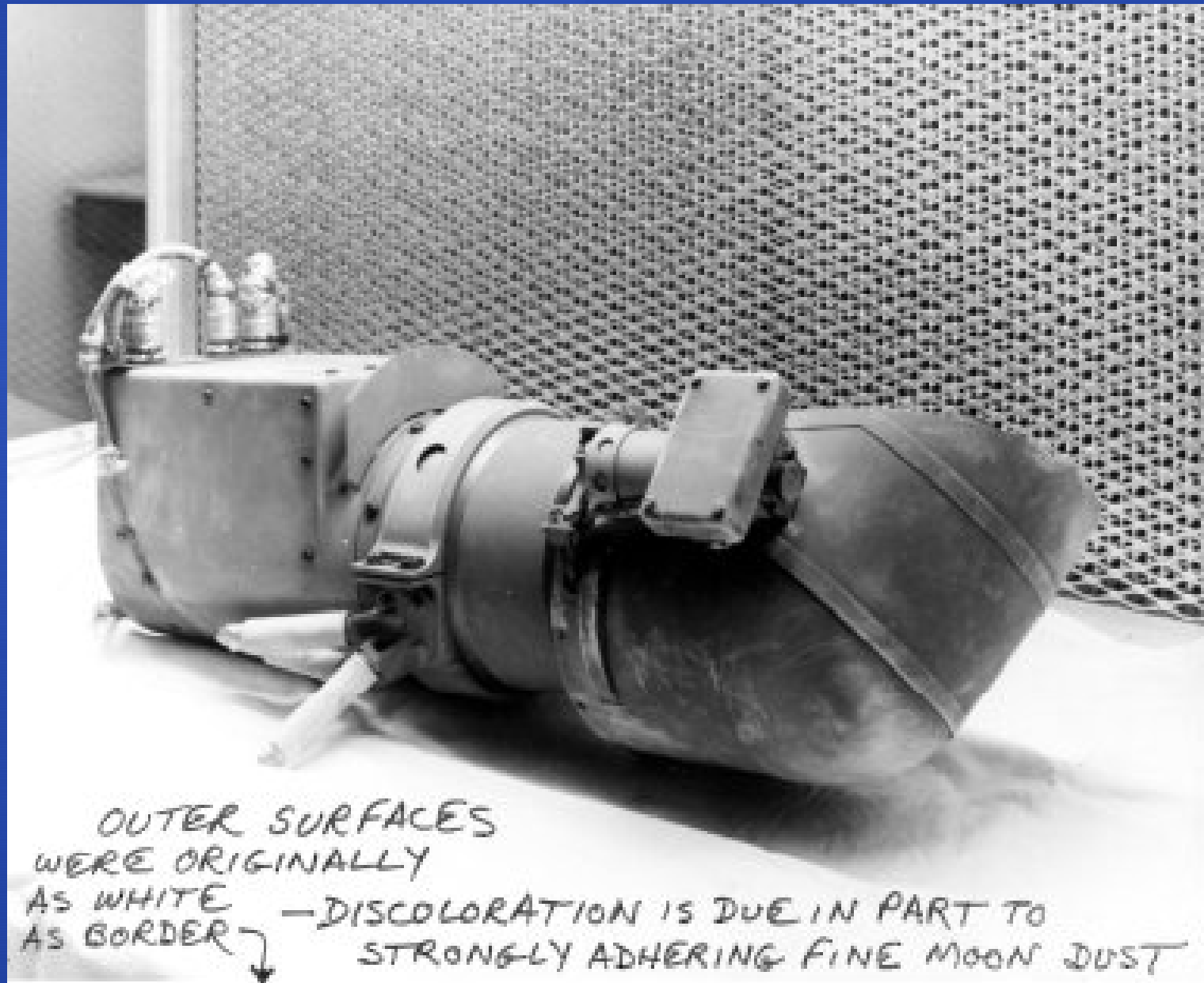
Both papers published in 1971 LSC Proceedings and *Analysis of Surveyor 3 material and photographs returned by Apollo 12* (NASA, 1972)



# Apollo 12's Pete Conrad with the Surveyor III camera



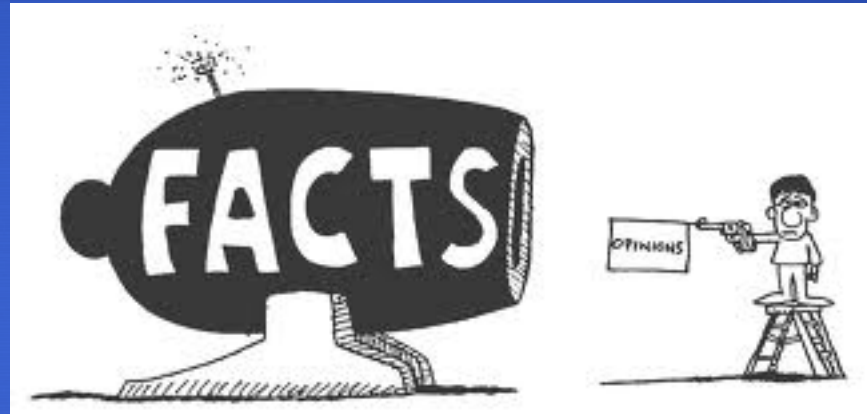
## Surveyor III camera, retrieved and in the lab





# Chapter 4:

How a claim became a fact



Gerald R. Taylor, Space microbiology, *Annual Review of Microbiology*, Volume 28, pp. 121-137, 1974:

“Various components of the American Surveyor III spacecraft, which had resided on the moon for 2.5 yr, were returned during the Apollo 12 mission and analyzed for the presence of viable microorganisms.... Except for the presence of *Streptococcus mitis*, which was considered by the investigators to have been deeply embedded within the camera body before it left the Earth, no viable microbes were recovered from any of the tested components.”

Taylor 1974 cited in 31 peer-reviewed journal articles 1974-2006.

Mitchell & Ellis claim reported as fact in NASA fact sheets, Wikipedia entries, Web sites ranging from credible to dubious....

# Chapter 5:

Contesting the claim

(Refuting the “fact” with visual evidence)



1998-2006: NASA PPO J. Rummel pokes around; L. Billings assists

2006-2011: Rummel, Allston, & Morrison keep poking around

2004 Astrobiology Science Conference: “Strep, lies (?) and 16mm film: Did *S. mitis* survive on the Moon? Should humans be allowed on Mars?” (J. Rummel)

2011 workshop, “The Importance of Solar System Sample Return Missions to the Future of Planetary Science,” LPI and NASA PSD: “A microbe on the Moon? Surveyor III and lessons learned for future sample return missions” (Rummel, Allston, Morrison)



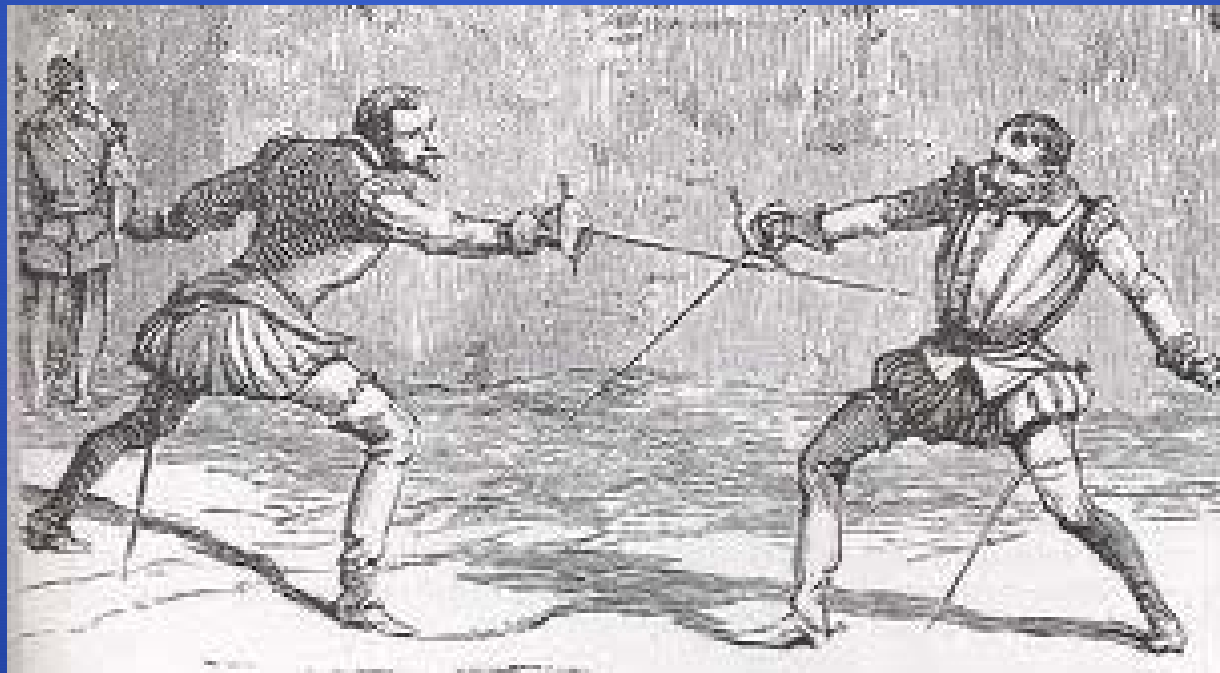
# Surveyor III assay, 1970...





## Chapter 6:

For the record...*S. mitis* – lunar survivor or post-flight interloper?



# Surveyor III camera assay



# Conclusions:

## Why should we care about this story?

- \* Astrobiology

- \* Planetary protection

- \* History and sociology of science

# Planetary protection

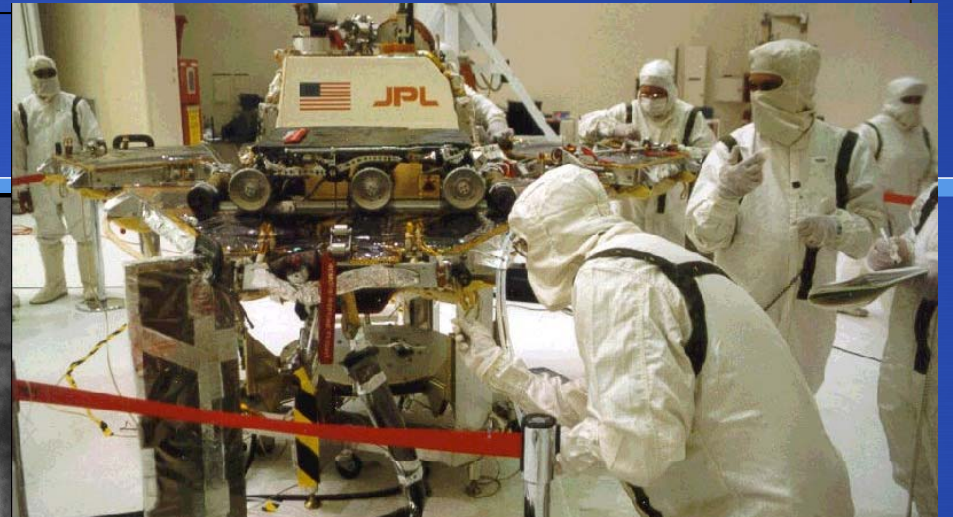




# A picture's worth a thousand words...



Surveyor III Camera assay, January 1970



Planetary protection final assay,  
Pathfinder, December 1996

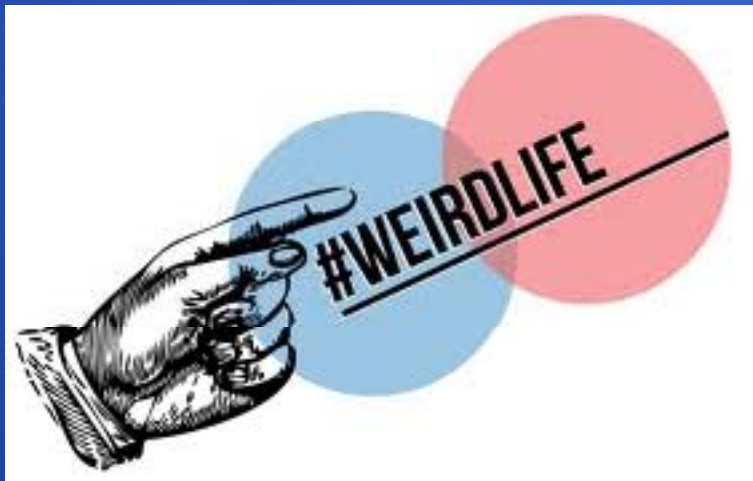
Genesis clean-room  
wear, June 2001







# Astrobiology



# *Acknowledgements*

Thanks to:

John Rummel, Judy Allton, Don Morrison, David Carrier, Michael Zolensky, and whoever I forgot to mention for their assistance with this project;

NASA Headquarters reference librarians for helping to track down key documents; and

NASA's Planetary Protection and Astrobiology programs for supporting this research.

